https://ntrs.nasa.gov/search.jsp?R=20190025353 2020-03-02T21:46:58+00:00Z

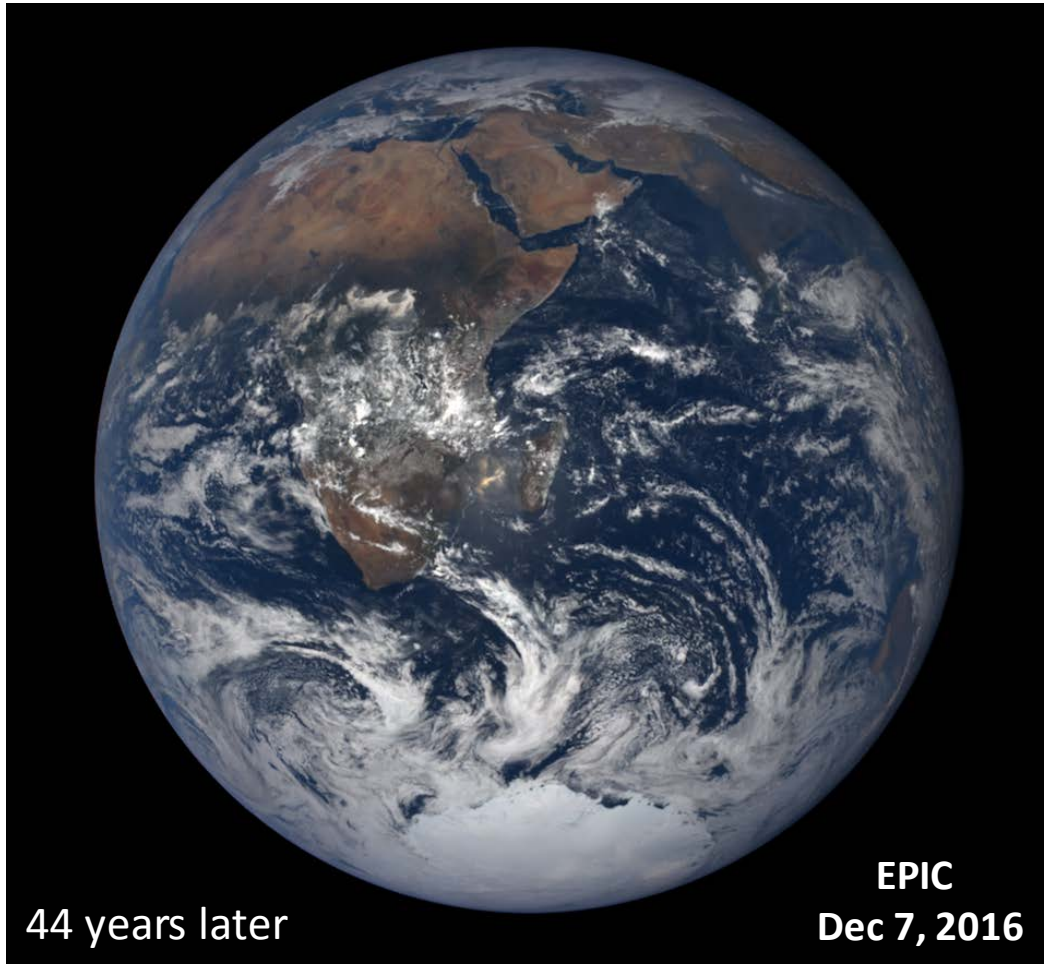
Spaceborne observations of sun glint and near-cloud aerosols

Tamás Várnai[1,2], Alexander Marshak[1], Guoyong Wen[1,3], Weidong Yang[1,4], Thomas Eck[1,4], Robert Levy[1], Alexander Kostinski[5]

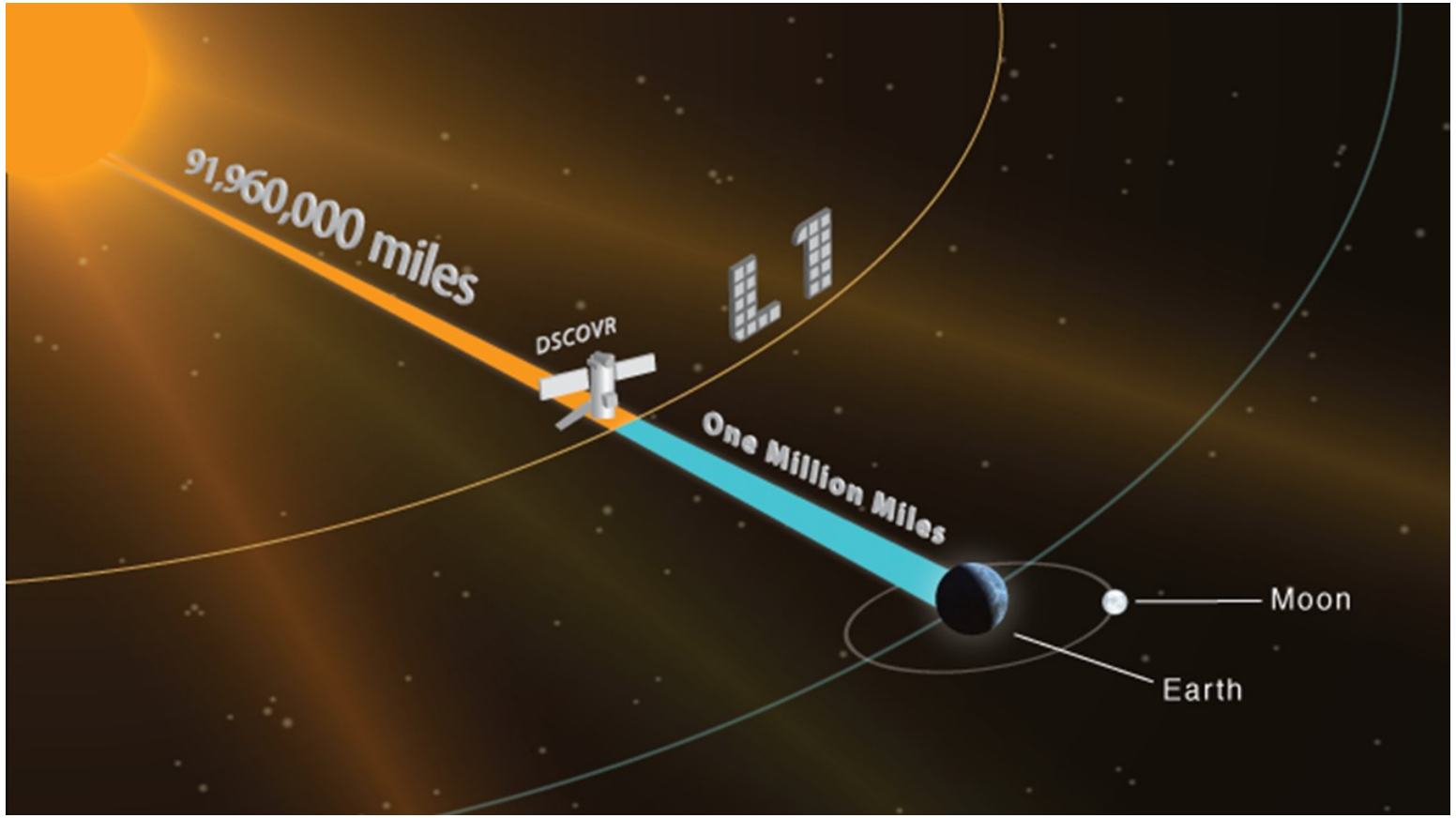
1: NASA GSFC, 2: UMBC JCET, 3: Morgan State Univ., 4: USRA, 5: Michigan Technological University

Earth Day tweet from Al Gore

DSCOVR's EPIC camera: images of Earth's sunlit side



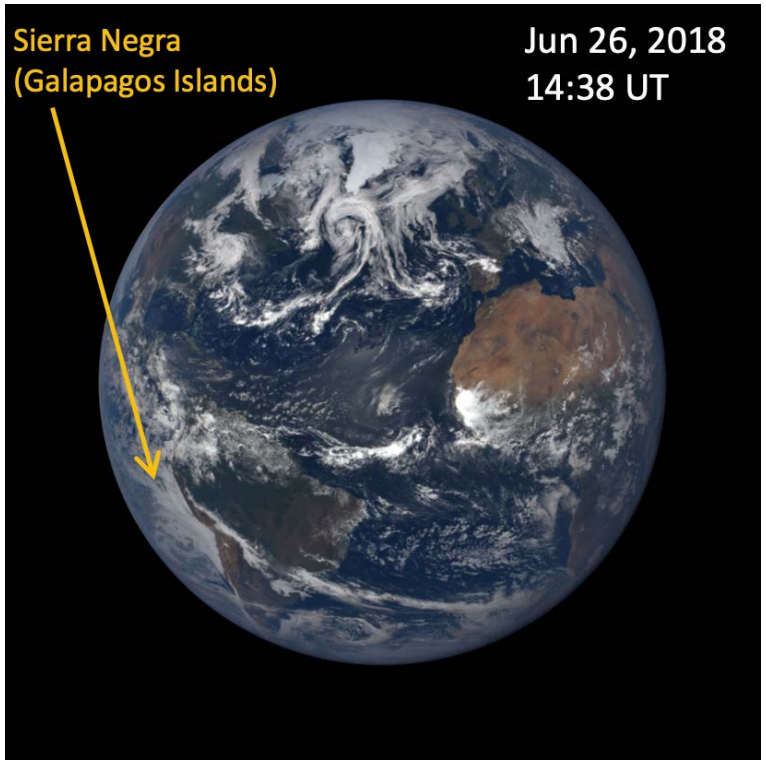
The DSCOVR spacecraft is at the L1 Lagrangian point

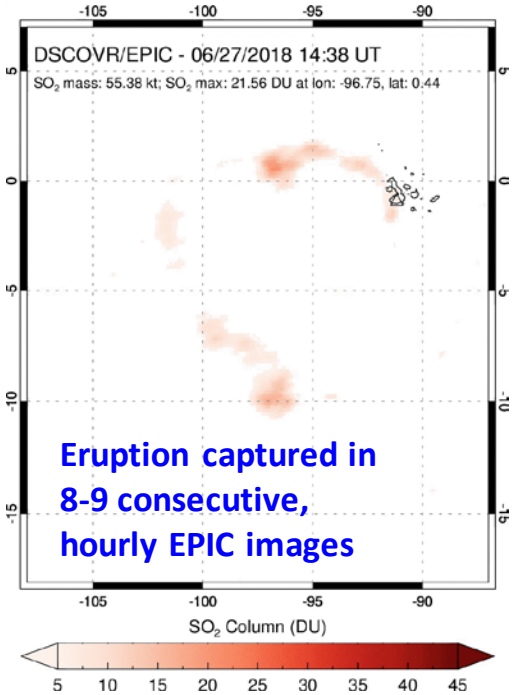


In 2018, Epic.gsfc.nasa.gov was the 9th most popular NASA website

Many DSCOVR science products are available

- Ozone
- Volcanic SO_2
- UV aerosol
- Clouds
- Atmospheric correction
- Vegetation



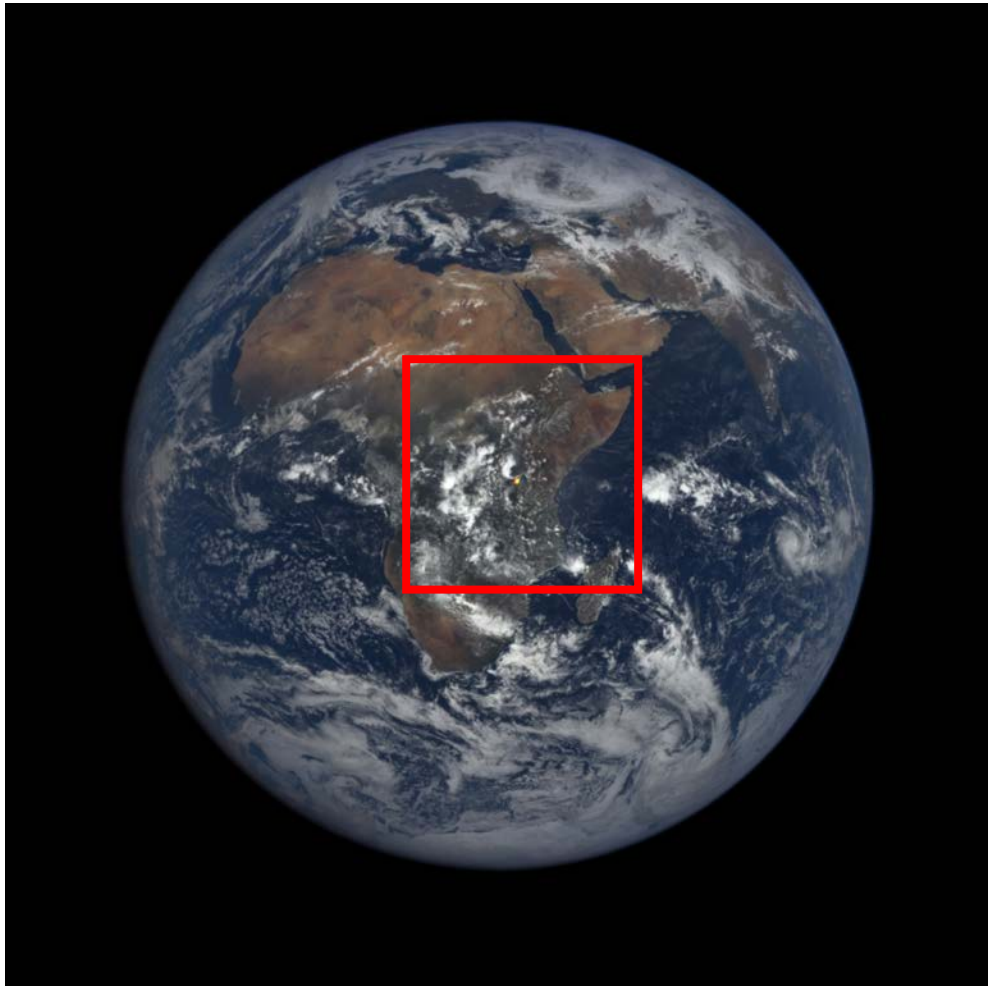


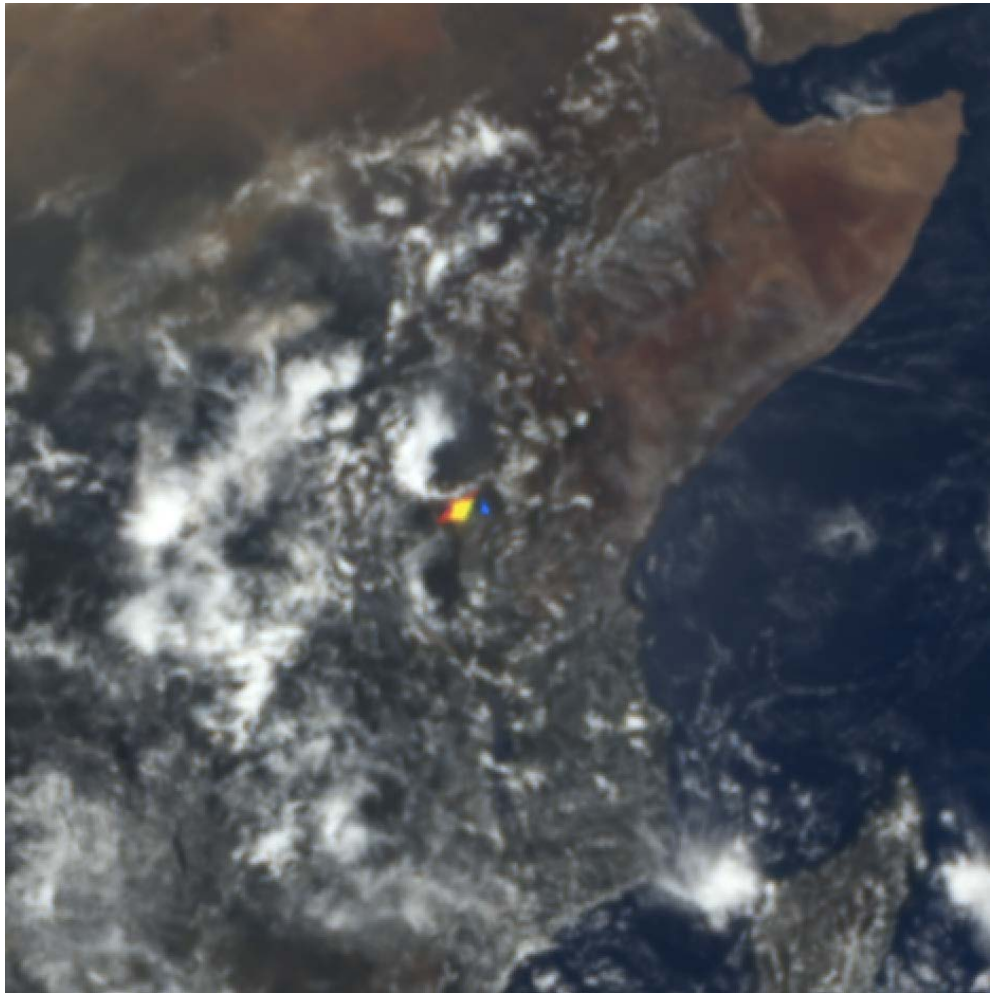
First observations of volcanic eruption clouds from the L1 Earth-Sun Lagrange point by DSCOVR/EPIC

S. A. Carn[1], N. A. Krotkov[2], B.L. Fisher[2,3], C. Li[2,4], and A.J. Prata[5]

[1]Michigan Technological University, [2]NASA GSFC, [3]SSAI, [4]ESSIC, [5]AIRES Pty Ltd. *GRL*, 2018

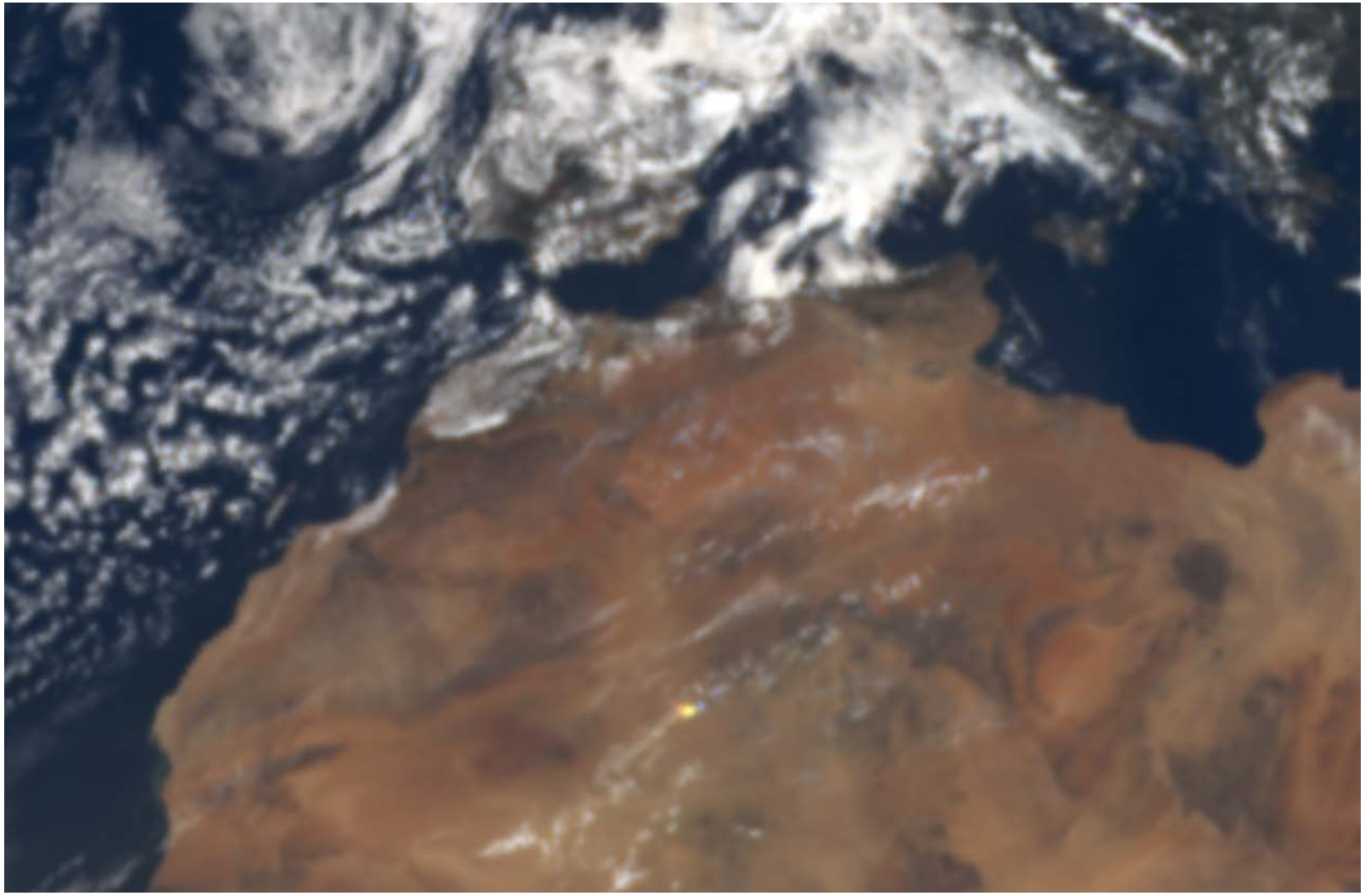
EPIC images often contain colorful bright spots





2016 03 17, 09:46 UTC

Likely cause of such spots: ice crystals in clouds



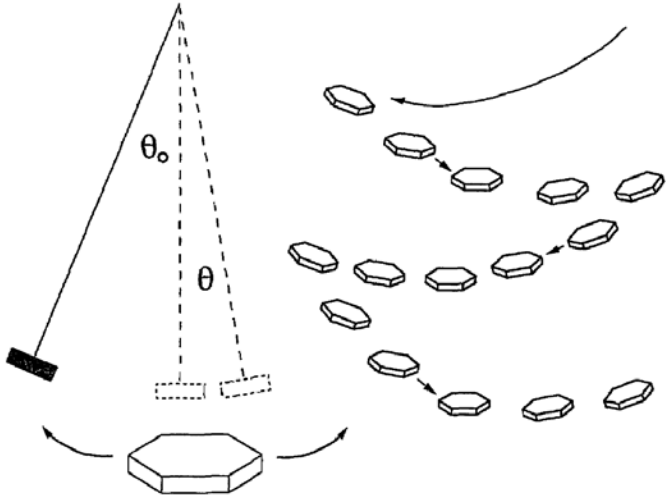


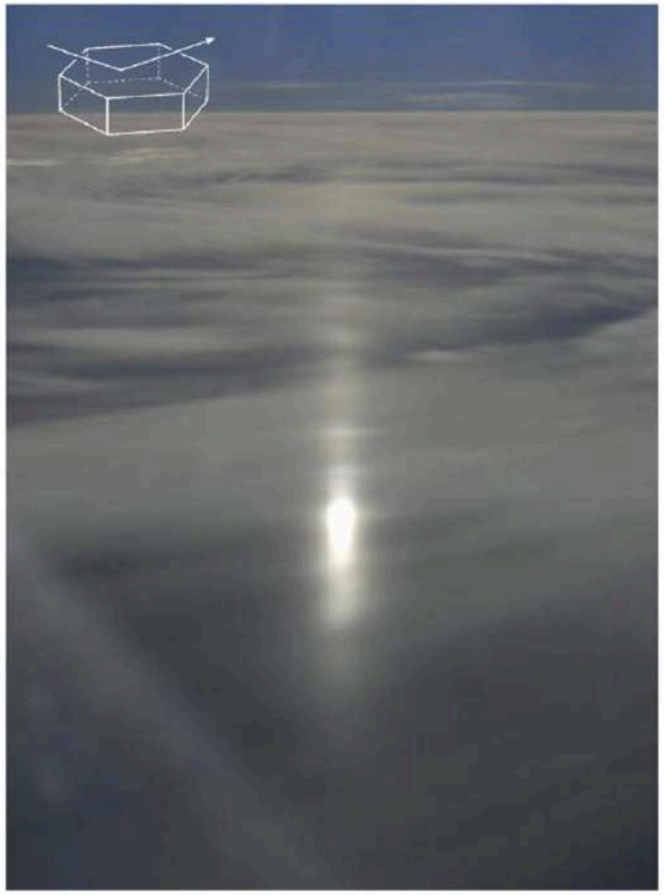
Fig. 8. Pendulum motion of a plate crystal.

20 July 1994 / Vol. 33, No. 21 / APPLIED OPTICS 4583

2018-05-28

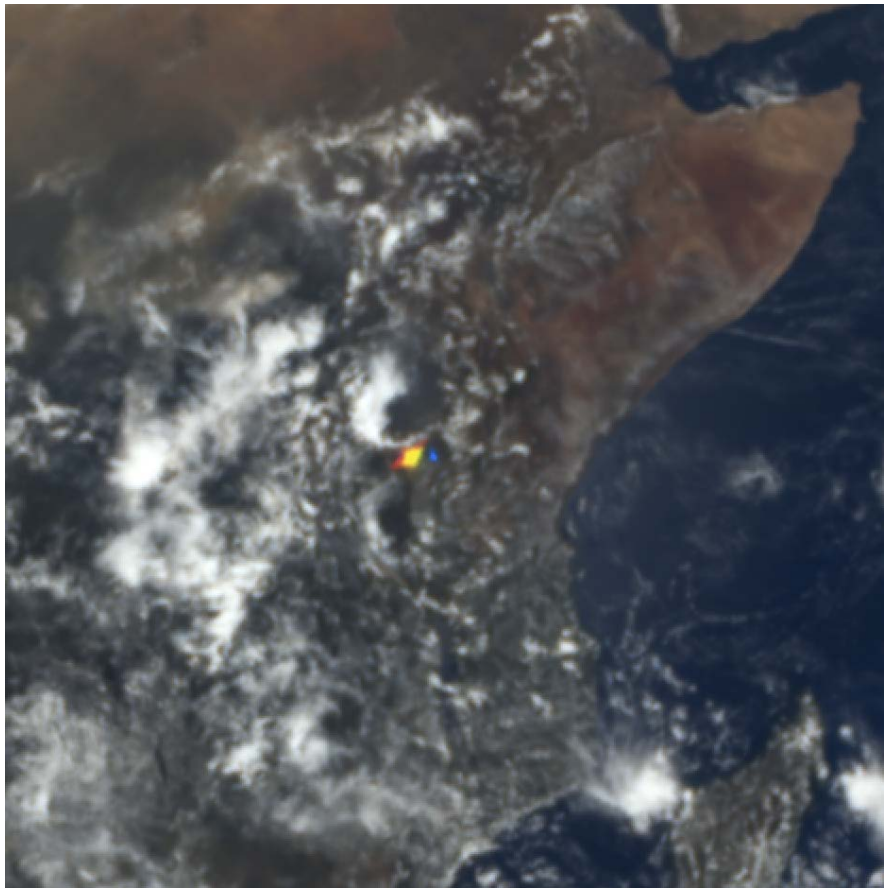
Glint form horizontal ice crystals in clouds (subsun)

Photo from aircraft



EPIC filter wheel

EPIC image

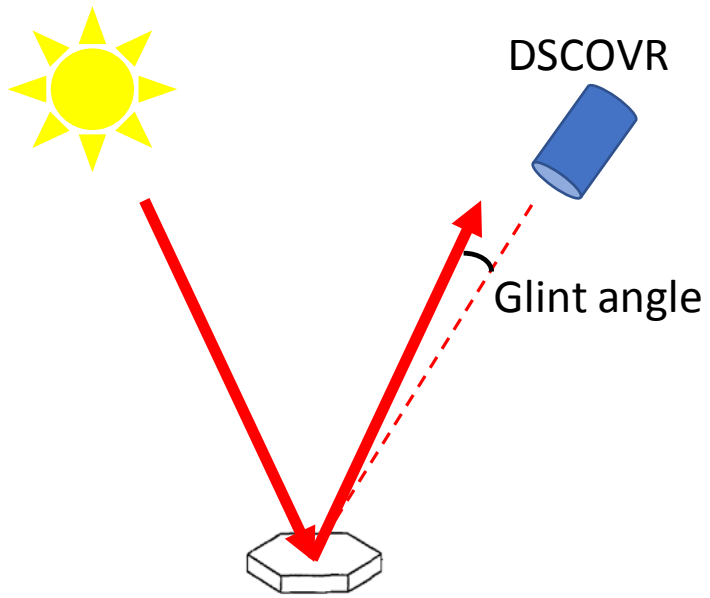


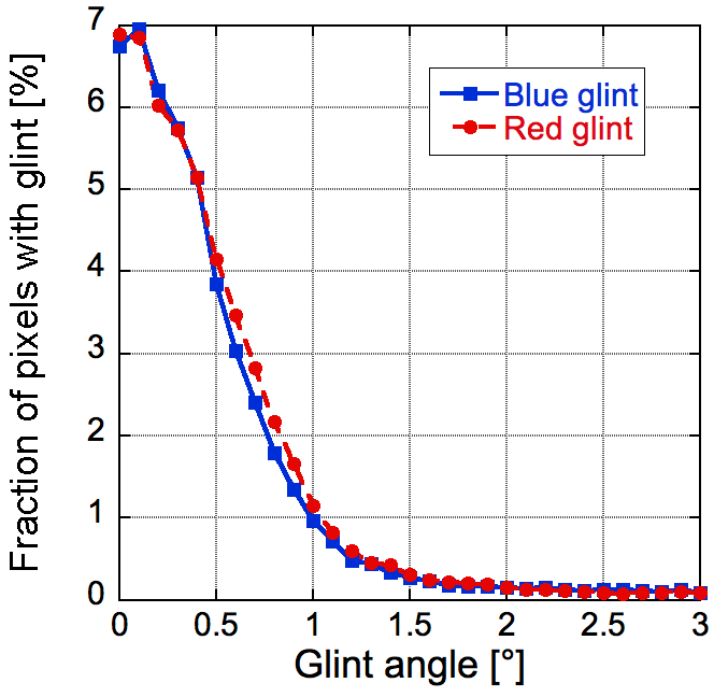
Können (2017, BAMS)

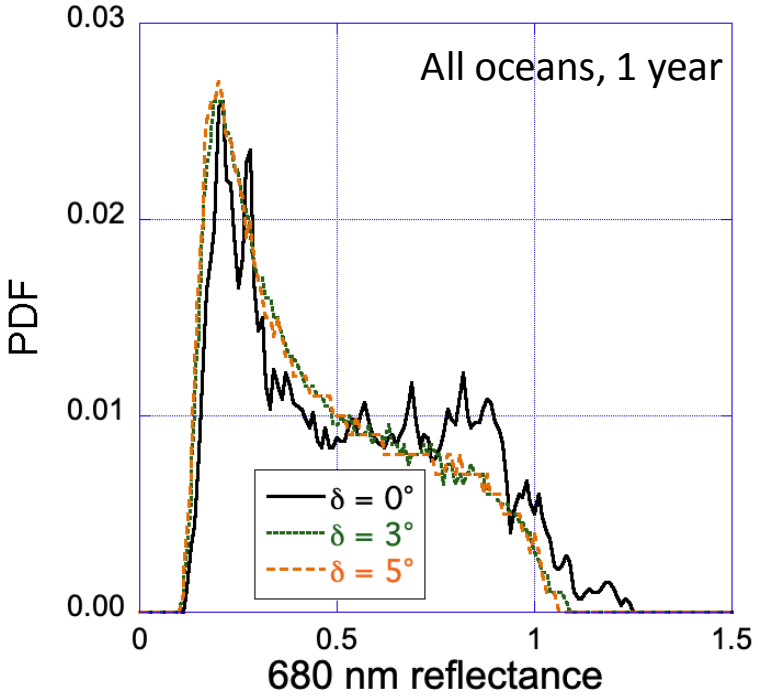
2016 03 17, 09:46 UTC

EPIC can be used as quasi multi-angle instrument

Statistically, how bright and wide are glints at various wavelengths?

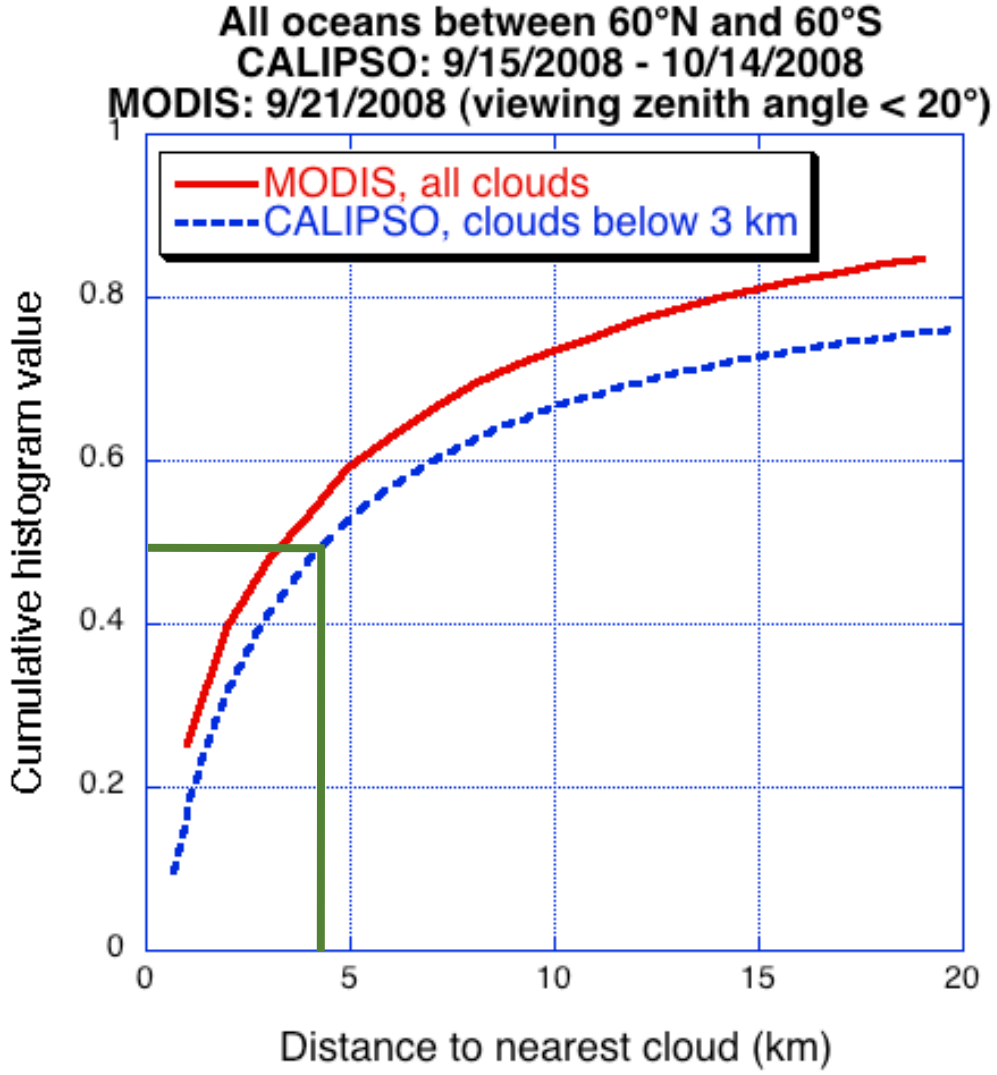






What are the prevalence, size, and tilt of horizontally oriented ice crystals, and how do these crystals affect cloud albedo?

Most clear areas are not too far from clouds



February 1, 2018

Aerosol remote sensing is especially difficult near clouds

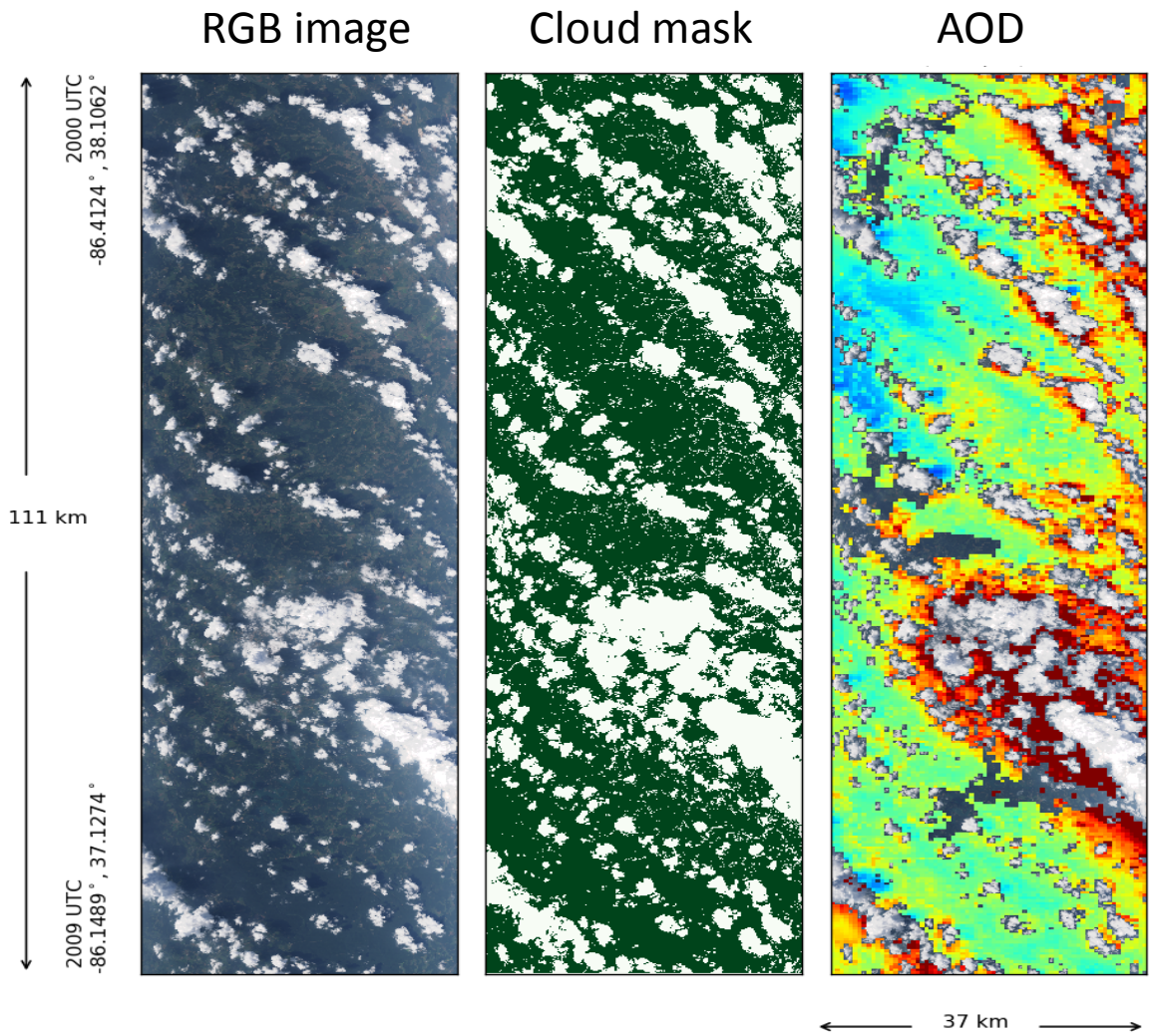
Saharan dust & clouds

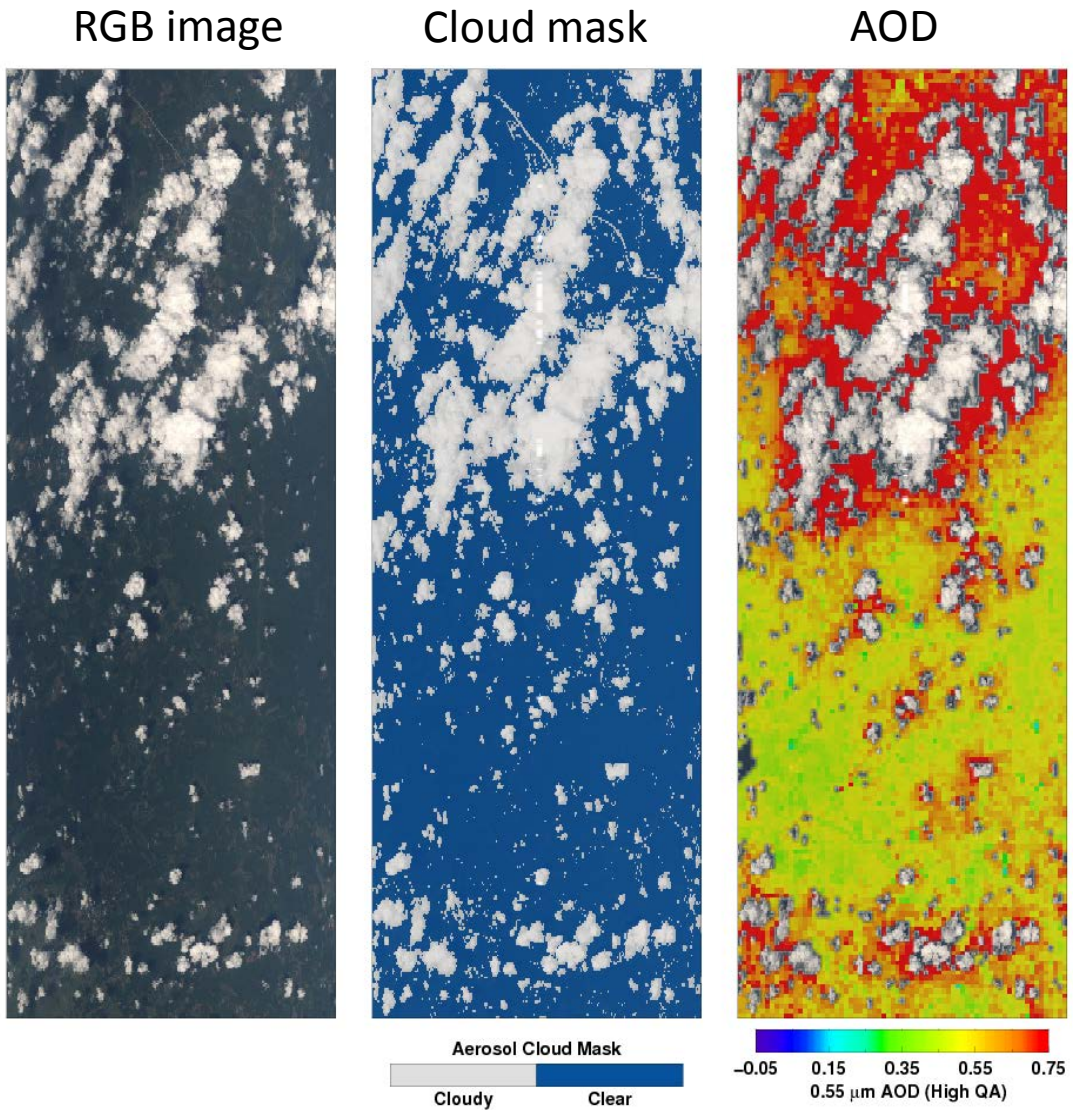
Arctic haze

View from G-IV, J. Dunion, NOAA

View from DC-8; A. Wisthaler, NOAA

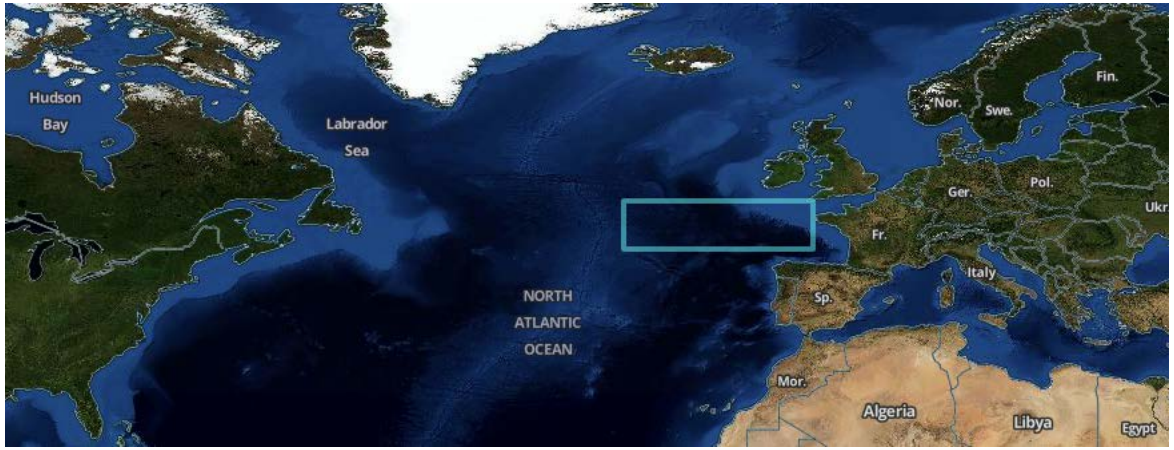
Aerosols are different near clouds; ignoring this would underestimate aerosol direct and indirect radiative effects

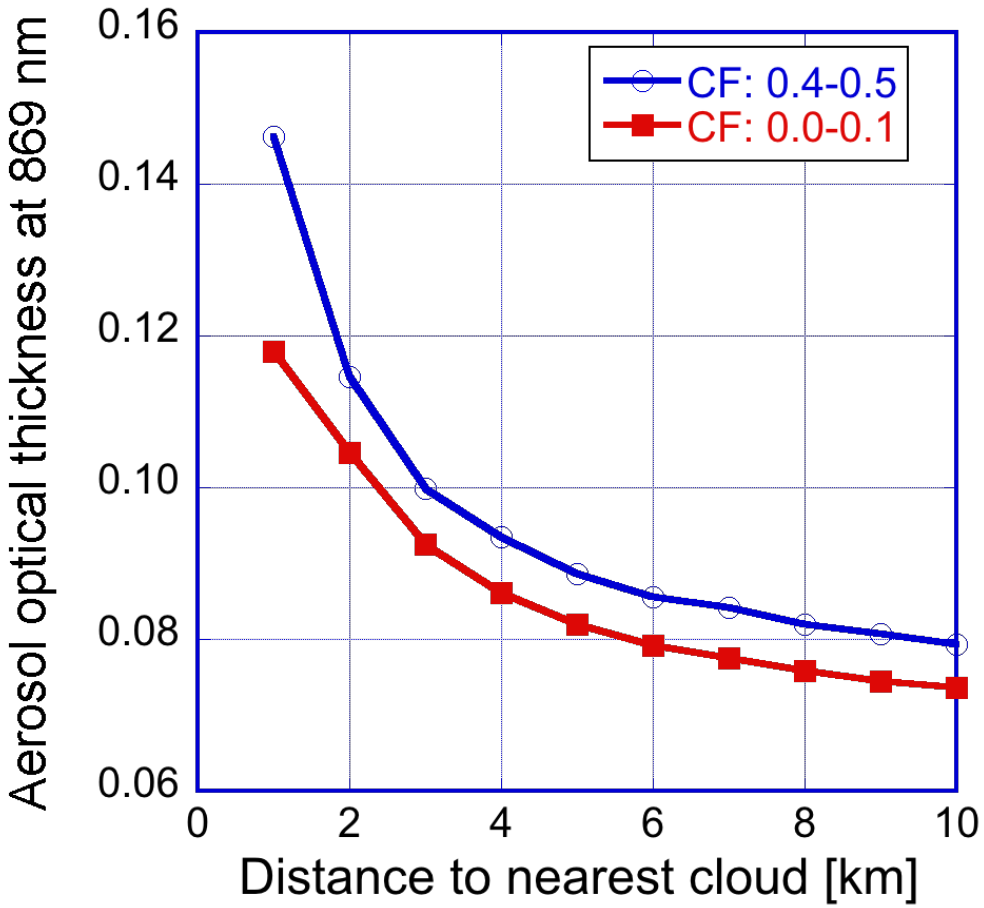




NASA ER-2 eMAS, SEAC4RS, Kentucky & Alabama, August 30, 2013

AOD increases near clouds

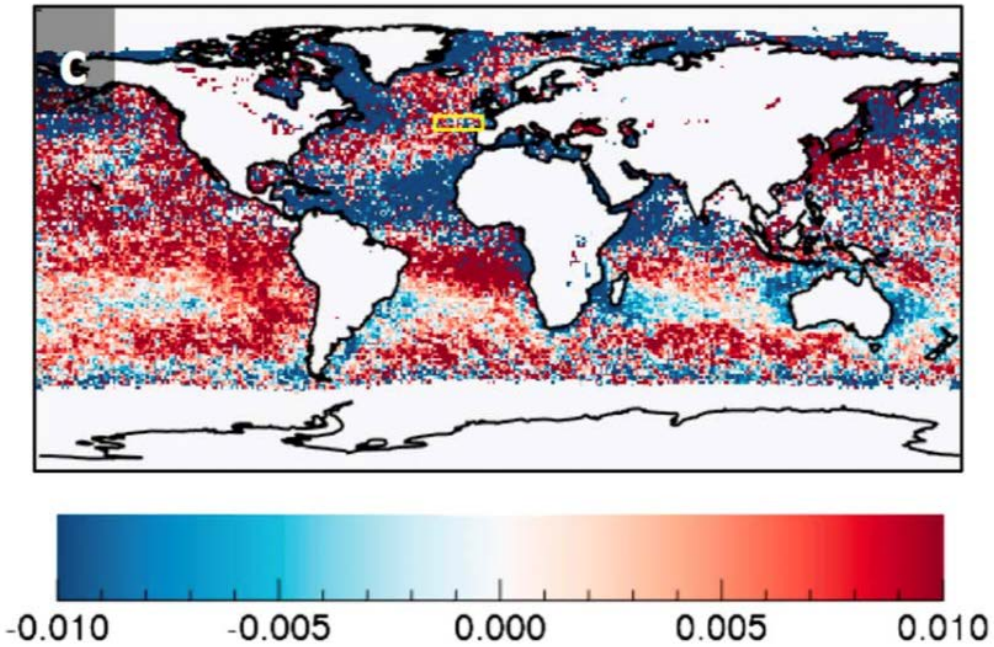




Retrieved 0.55 µm AOD is 50% higher in the half of data that is closer to clouds

Sept. 14-29, 2002-2011

Cloud effects on size distributions are more complex



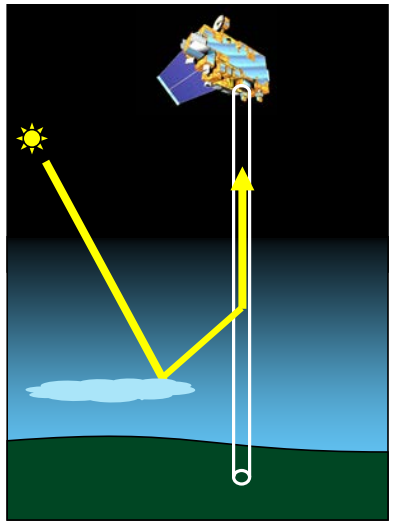
AOD increases more with CF for

Coarse mode Small mode

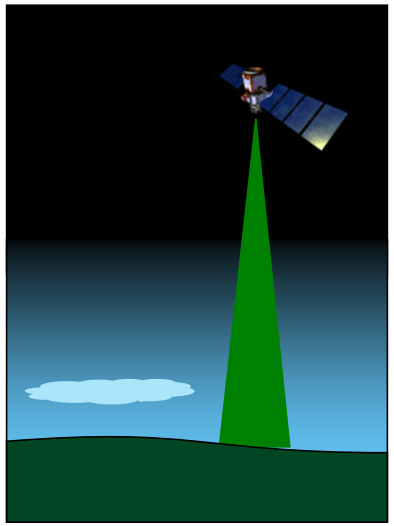
MODIS Aqua, JJA 2012-2014

Several processes contribute to near-cloud enhancements

MODIS



CALIOP

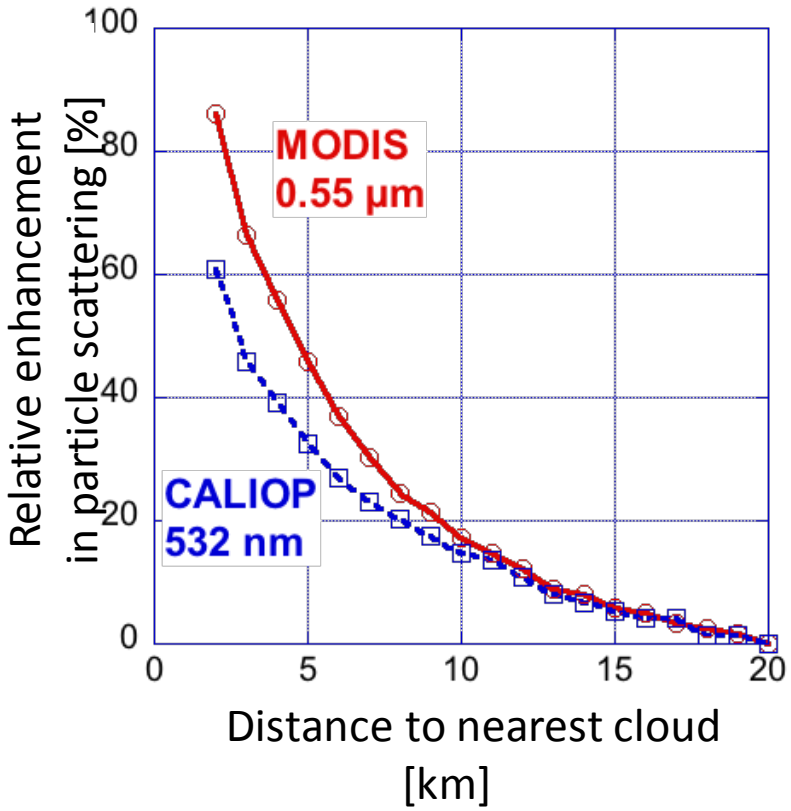


Both MODIS & CALIOP observe:

- Aerosol swelling
- Cloud processing
- Cloud contamination

MODIS data also affected by:

- 3D enhancement
- Instrument blurring

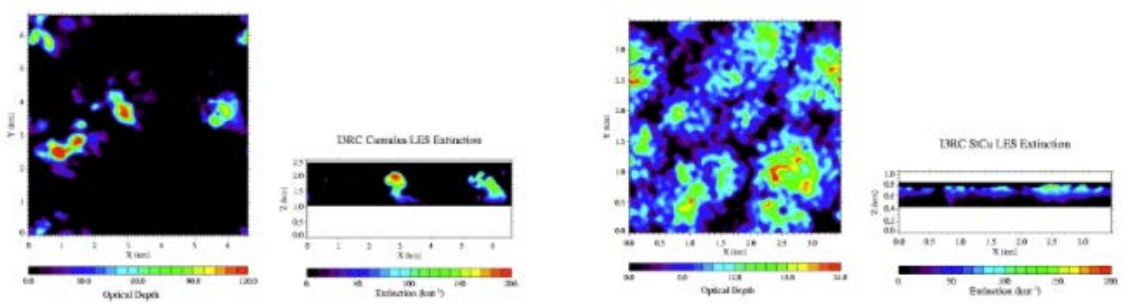


Global oceans, 60°N – 60°S, Nov. 2006 - Oct. 2007

Online 3D radiative transfer simulator is available

- Quick 1D & 3D Monte Carlo simulations through web interface (15 sec - 4 min)
- Goal: help initial exploration of ideas, class projects
- Part of the Intercomparison of 3D Radiation Codes (I3RC) project: i3rcsimulator.umbc.edu

Sample input LES fields



Summary

- We explore using EPIC data to constrain the prevalence and size of horizontally oriented ice crystals and their impact on Earth's albedo.

- Clouds and cloud-related processes affect a large portion of aerosols; we seek to help better characterize the affected aerosols and their radiative impacts.